EXPANDED SITE INSPECTION
of the
RT. 7 CHEMICAL DUMP (MD-75)/
NEW JERSEY FIREWORKS SITE

MAY 2005

ORIGINAL

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of the
Rt. 7 Chemical Dump (MD-75)/New Jersey Fireworks Site

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1.0 INTRODUCTION

1.1 Authorization

This Expanded Site Inspection (ESI) was performed by the Maryland Department of the Environment (MDE), Waste Management Administration, Environmental Restoration and Redevelopment Program under a Cooperative Agreement with the U.S. Environmental Protection Agency (EPA).

1.2 Scope of Work

MDE's Federal Superfund Division performed an ESI of the Rt. 7 Chemical Dump, EPA identification number MDSFN0305563. The purpose of the ESI is to characterize potential impacts from disposal activities at the former dump known as the Rt. 7 Chemical Dump and the area around the sparkler building on the adjacent New Jersey Fireworks (NJF) property on groundwater, surface water, soil and sediment in the vicinity. The scope of the investigation included collecting samples of on-site soil, groundwater, surface water and sediment, as well as collecting off-site soil, surface water and sediment to determine if hazardous wastes have impacted the properties and vicinity.

1.3 Executive Summary and Conclusions

On November 17, 1971, a Maryland Water Resources Administration (WRA) official discovered that New Jersey Fireworks was discharging wastewater, which contained barium salts, from its sparkler mixing area to an unnamed tributary of Mill Creek. As a result, on December 22, 1971, the WRA issued an order for New Jersey Fireworks to stop discharging to the creek and arrive at an approved treatment and disposal method, which would prevent discharge to the creek exceeding 1 mg/l barium.

According to MDE file records, in 1978 New Jersey Fireworks was cited by WRA for unpermitted disposal of their fireworks waste into the water-filled quarry located on the extreme western portion of the property now known as the Rt. 7 Chemical Dump. In addition to potential groundwater impact, another concern of the State was that some water from the quarry was escaping into the stream. Sampling by the State around that time indicated that elevated levels of barium were detected in the quarry/pond. Due to the State's concerns, there is some indication in the files that plant personnel had begun removing some waste from the quarry, burning it at the adjacent burning area, and taking the ash to the County Landfill; however, later documents suggest that the improper disposal into the quarry continued. In November 1980, an Administrative Order was issued to the company by the Department of Health and Mental Hygiene (DHMH). The Order required that New Jersey Fireworks close out the dump area in order to protect human health and the environment.

The State of Maryland conducted a Preliminary Assessment and Ecology & Environment conducted a sampling of the Rt. 7 Chemical Dump in 1980, at which time results indicated

contamination of the on-site ponded area. No other details were given other than the contamination had not migrated off-site.

In December 1983, the EPA (NUS Halliburton) conducted a Site Inspection of the Rt. 7 Chemical Dump that included collecting samples from on-site surface waters and an adjacent stream. Lead detected in upstream and downstream aqueous samples was determined to be unrelated to the site. Only butyl benzyl phthalate (15 parts per billion [ppb]) was detected in aqueous samples, and it was determined to pose no evident hazard. A high concentration of barium (19,300 ppb) was detected in the on-site pond aqueous sample, but no barium was detected off-site. Trace amounts of cadmium, cobalt, and chromium were also detected.

In June 1992, the MDE submitted a Level I Hazard Ranking System score on the dump site to EPA, and reported that New Jersey Fireworks Company still owned the site, and confirmed that the State Highway Administration disposed of fill dirt from road construction in the on-site pond from 1983 to 1986. MDE recommended considering the site for No Further Remedial Action Planned (NFRAP) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

In September 1992, MDE submitted to EPA a revised Level I Site Investigation Prioritization (SIP) on the Rt. 7 Chemical Dump, which recommended a NFRAP status for the site, based on existing analytical data.

In 1999, the New Jersey Fireworks site (the eastern portion of the property) was inspected by the Federal Bureau of Alcohol, Tobacco, and Firearms (ATF) and the MDE. The inspection revealed that large amounts of fireworks were being stored in an unsafe manner. According to representatives of the ATF, the on-site manufacturing of fireworks ceased in approximately 1991. The types of fireworks previously manufactured include sparklers and black powder explosives. At the time of the ATF/MDE inspection, the property was being used to repackage imported fireworks.

The 1999 ATF/MDE inspection also revealed that several buildings on site contained old fireworks. Many of these buildings were in poor condition. Several pit-like depressions were located in a wooded area and were previously used for burning and disposal of old fireworks. Rusted 30-gallon and 50-gallon drums littered the site. Some of the drums still possessed legible labels indicating that they contained potassium perchlorate. Lastly, a waste disposal area was observed on the south side of the property, which consisted of wooden pallets, drums, aerosol cans, oil containers, auto parts, cinders and other scattered debris, some of which looked like asbestos containing material.

The MDE conducted a Site Investigation focused on the New Jersey Fireworks portion of the property in April 2000. Surface and subsurface soil, groundwater, surface water and sediment samples were collected and analyzed for a full scan of all Target Analyte List and Target Compound List pollutants. Results of the chemical analyses revealed only metals at levels above benchmark levels. Analysis of select samples failed to reveal the presence of perchlorates. The toxicological evaluation revealed unacceptable risk from ingestion of surface

soil and groundwater, and dermal contact with groundwater beneath the site due to metals contamination.

In October 2001, MDE met with NJF representatives and it was determined that MDE would collect soil samples to further characterize the burn pit area and areas near the many dilapidated buildings and trailers that still contained potentially hazardous wastes. Results from the field screening conducted on December 21, 2001 revealed elevated levels of antimony at the entrance of two of the buildings.

On March 1, 2002, MDE collected additional field screening samples approximately 10 to 20 feet from the building entrances to determine if metals contamination was restricted to those areas nearest the building entrances. An area devoid of vegetation near the former sparkler manufacturing building was sampled and elevated levels of barium (35,400 parts per million [ppm] and 39,300 ppm) were detected.

On May 2, 2003 MDE's Waste Management Administration became involved in a developing investigation of perchlorate in the groundwater impacting the Elkton well field. In response to known perchlorate contamination of groundwater at the nearby ATK (formerly Morton Thiokol) MD-100 CERCLA site, MDE's Water Management Administration assessed nearby community wells. Chemical analysis of samples collected from two operational wells adjacent to NJF revealed perchlorate contamination at 5 ppb and 0 ppb. Two additional wells considered for planned expansion further east were sampled and their results detected perchlorates at 28 ppb and 3 ppb.

In May 2004, MDE installed six monitoring wells in the vicinity of the study area to assess potential impacts to the groundwater (principally from perchlorates) and to assess possible hydraulic connections with the potential source areas to the NJF production well known to have perchlorate contamination. Pairs of monitoring wells were installed at the former Rt. 7 Dump and near a former pit on located on property approximately 1,400 feet northwest of the NJF sparkler building. Two intermediate monitoring wells were installed at depths similar to the NJF production well approximately 325 feet and 1,000 feet east of the sparkler building.

In August 2004, MDE initiated this ESI of the former Rt. 7 Dump and NJF site in response to the recent discovery of perchlorate contamination in nearby wells. This ESI assesses potential releases from the likely source areas, principally the former Rt. 7 Dump known to have received munitions and fireworks manufacturing wastes and the NJF sparkler building area. Results of the investigation identified low level perchlorate contamination in the surface soil near the former Rt. 7 Dump area. Elevated levels of perchlorate contamination were identified in the NJF production well, the soil and groundwater near the sparkler building and in a monitoring well approximately 1,000 feet east of the sparkler building area (along the likely easterly/southeasterly direction of groundwater flow). Perchlorate contamination was also identified in the surface water and sediment samples collected in an unnamed tributary of Mill Creek near the sparkler building area. Additionally, the soil sampling identified elevated levels of metals (arsenic, barium, lead, and mercury) above MDE and/or EPA standards, especially near the sparkler building (barium at 47,600 ppm).

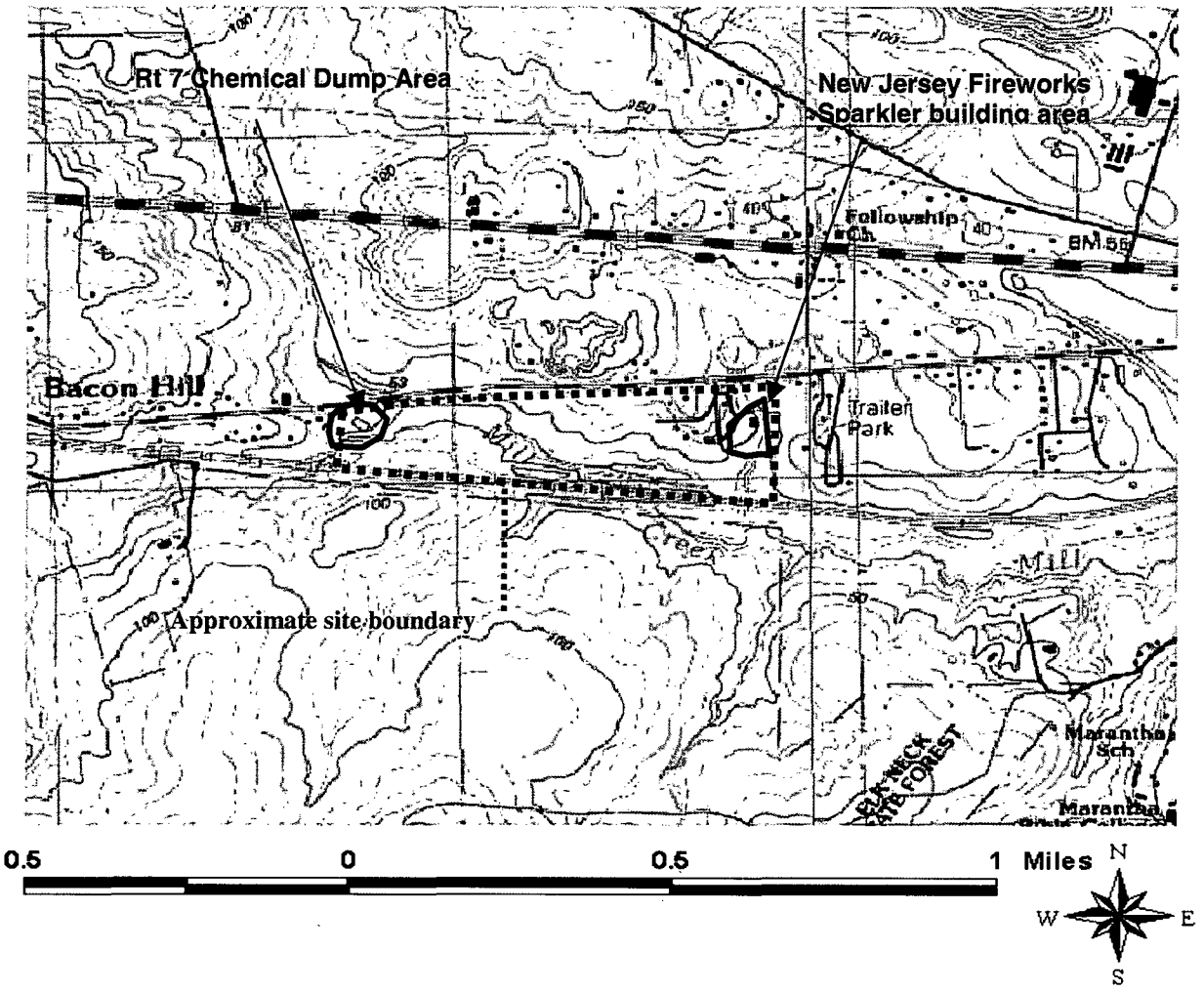
The Toxicological Evaluation of the chemical analyses from the samples collected during the ESI utilized a commercial use scenario and revealed exceedances for noncarcinogenic and carcinogenic risks to child and youth visitor populations, and to the adult and construction worker populations. Exposure pathways that potentially present unacceptable risk due to the contamination that was detected on site are from one or more of the following: ingestion of, and dermal contact with the soil and groundwater due to barium, chromium, arsenic and/or potential additive effects. Based upon the potential unacceptable level of risk from exposure to the contamination that was detected on site, MDE is recommending further investigation to better characterize the sparkler building area for remedial actions.

2.0 SITE DESCRIPTION

The Rt. 7 Dump/NJF site is located approximately 2.4 miles west of Elkton and 2.5 miles east of the town of North East in Cecil County, Maryland. The coordinates are approximately 39° 36' 15" N latitude and 75° 52'50" W longitude. The site consists of the 1-acre former Rt. 7 Dump and the 0.5-acre sparkler building area on the former NJF site located at 1726 E. Old Philadelphia Road. The former Rt. 7 Dump and the former NJF sites are situated on three parcels that comprise approximately 63.7 acres and are situated in a rural area just north of the Elk Neck State Forest. Old Philadelphia Road (Route 7) forms the northern border of the site. The Forest View Village Trailer Park borders the site to the east. Mill Creek and Amtrak railroad tracks form the southern border of the site (Figure 1). Residences are situated to the north and a septic tank cleaning business in situated to the west.

The site ranges from approximately 25 feet to 75 feet above Mean Sea Level (MSL) and gently slopes to the south towards Mill Creek. The western portion of the site (Rt. 7 Dump) consists of a former clay quarry filled with demolition and construction debris disposed by the State Highway Administration during the early 1980s. This former disposal area/pond contains a shallow pool of surface water less than 1 foot deep and approximately 20 feet in diameter. The eastern portion of the site (NJF sparkler building) is open and contains several widely spaced warehouse buildings while the central portion of the site is wooded. The roads on the NJF portion of the Site are unimproved and the easternmost portion of the Site is fenced and access is restricted by a locked gate. The Rt. 7 Dump area is also fenced. The Amtrak railroad and Mill Creek act as a natural barrier to the site along the southern border.

Figure 1: Site Location/Topographic Map



2.1 Site Ownership and Site Use

In the early 1900s, the far western 2 acres of the site was utilized as a clay quarry that supplied clay to a brick manufacturer. During World War II, by-products of munitions production, as well as scrap rubber from the Bayshore Rubber Plant, were disposed of at that site.

In 1956, the NJF Company purchased the above 2 acres and the adjacent 56 acres east of the disposal area. The Company used the eastern portion of the site for the manufacture of Class C fireworks and the far western portion (Rt. 7 Chemical Dump) for waste disposal from the production of the fireworks. The dump site was never permitted. The disposal area consisted of a burn pad and a water-filled pit that was used to dispose of ash material. By 1980, wastes were burned at the dump, and the ash was transported to the county landfill.

Between 1983 and 1986, the State Highway Administration used the on-site pond at the dump to dispose of fill dirt from road construction. Most of the fill dirt consisted of clays.

With the cessation of manufacturing in 1993, the storage and production buildings were left abandoned. Raw materials such as black powder, oxidizers, fuels, binders and other components remained in opened and/or damaged containers and left in piles on countertops, trays and scattered about on the floors in the dilapidated buildings and trailers.

On June 30, 1999, both parcels that comprise the 58-acre NJF site were transferred to Sun and Star, LLC. Later that same year, extensive cleanup of the property was initiated. The dilapidated buildings, trailers and hazardous materials were removed from the site and a new office building and an approximate 28,000 square foot warehouse were erected. NJF now only imports, repackages and distributes "Class C" fireworks.

2.2 Regulatory Actions

On November 17, 1971, a Maryland Water Resources Administration (WRA) official discovered that NJF was discharging wastewater, which contained barium salts, from its sparkler mixing area to a tributary of Mill Creek. As a result, on December 22, 1971, the WRA issued an order for NJF to stop discharging to the creek and arrive at an approved treatment and disposal method, which would prevent discharge to the creek exceeding 1 mg/l barium.

The operation manager then began to hold the sparkler mixing wash-down water in two concrete settling pits, then into a seepage/evaporation pond with no outlet. Some of the solids were reclaimed for further use in manufacturing and some was disposed of in the "old quarry," which probably refers to the old clay quarry at the western end of the property. The liquids simply evaporated in the settling process. File records from the early to mid 1970s indicate that NJF had a groundwater permit (73-DP-0333) for these settling pits from the WRA.

According to MDE records NJF was cited by WRA for unpermitted disposal of their fireworks waste into the water-filled quarry in 1978. In addition to potential groundwater impact, another concern of the State was that some water from the quarry was escaping into the stream. Sampling by the State around that time indicated that elevated levels of barium were detected in the pond. Due to the State's concerns, there is some indication in the files that plant personnel had begun removing some waste from the quarry, burning it at the adjacent burning area, and taking the ash to the County Landfill. Later documents suggest that plant personnel may have continued to improperly dispose of the waste into the quarry. In November 1980, an Administrative Order was issued to the company by the DHMH. The Order required that NJF close out the dump area in order to protect human health and the environment.

In 1999, the NJF site (the eastern portion of the property) was inspected by the Federal Bureau of Alcohol, Tobacco, and Firearms (ATF) and the MDE. The inspection revealed that large amounts of fireworks were being stored in an unsafe manner. According to representatives of the ATF, the on-site manufacturing of fireworks ceased in approximately 1991. The types of

fireworks previously manufactured include sparklers and black powder explosives. The property at the time was being used to repackage imported fireworks.

The 1999 ATF/MDE inspection also revealed that several buildings on site contained old fireworks. Many of these buildings were in poor condition. Several pit-like depressions were located in a wooded area and were previously used for burning and disposal of old fireworks. Rusted 30-gallon and 50-gallon drums littered the site. Some of the drums still possessed legible labels indicating that they contained potassium perchlorate. Lastly, a waste disposal area was observed on the south side of the property, which consisted of wooden pallets, drums, aerosol cans, oil containers, auto parts, cinders and other scattered debris, some of which looked like asbestos containing material.

2.3 Remedial Actions

As a result of the ATF/MDE inspection in May 1999, extensive cleanup of the NJF site has occurred. Nearly all of the dilapidated buildings have been demolished and removed. All of the abandoned aboveground storage tanks, most of the empty drums, most of the waste pile, and trailers that housed improperly stored hazardous and suspected hazardous materials have been removed with oversight of MDE's Hazardous Waste Enforcement Division. A new office and gravel parking lot have been built and an approximate 28,000 square foot warehouse erected on the southern portion of the property.

No remedial actions have occurred on the Rt. 7 Dump portion of the site.

3.0 ENVIRONMENTAL SETTING

3.2 Surface Water

Overland flow from the site and surrounding highlands discharges directly into Mill Creek on the western and southern borders of the site (near the Rt. 7 Dump) (Figure 1) or into an unnamed tributary of Mill Creek on the eastern portion of the site (near the sparkler building) and then travels approximately 0.19 mile south before discharging into Mill Creek at the extreme southeastern portion of the NJF property. Mill Creek flows eastward approximately 1.57 miles and empties into Little Elk Creek across from Hollingsworth Park point. Little Elk Creek flows southerly for approximately 1.01 miles before as it joins Big Elk Creek in a marshland near Elkton Landing. Big Elk Creek flows southwesterly for approximately 2.10 miles before discharging into the Elk River at Old Frenchtown Wharf. The terminus of the 15-mile surface water pathway ends in the Elk River near Thackery Point, approximately three miles from the mouth of the Elk River and the Chesapeake Bay (Figure 2).

According to US Geological Survey gauging stations, Mill Creek, Little Elk Creek and Big Elk Creek flow volumes are less than 100 cubic feet per second (cfs). Elk River is estimated to be greater than 100 cfs and less than 1,000 cfs and is a tidally influenced fresh water body with salinity ranging 0-5 parts per trillion. Approximately four acres of wetlands occur along Mill Creek on the NJF property. Palustrine wetlands occur again approximately 1.1 miles downstream along Mill Creek and are continuous to the confluence of Big Elk Creek and the Elk River where the wetlands classification changes to estuarine open-water. The entire site is outside of the 500-year floodplain. No surface water intakes are located in the 15-mile surface water target distance limit.

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Figure 2: Wetland Map (15-mile Surface Water TDL)

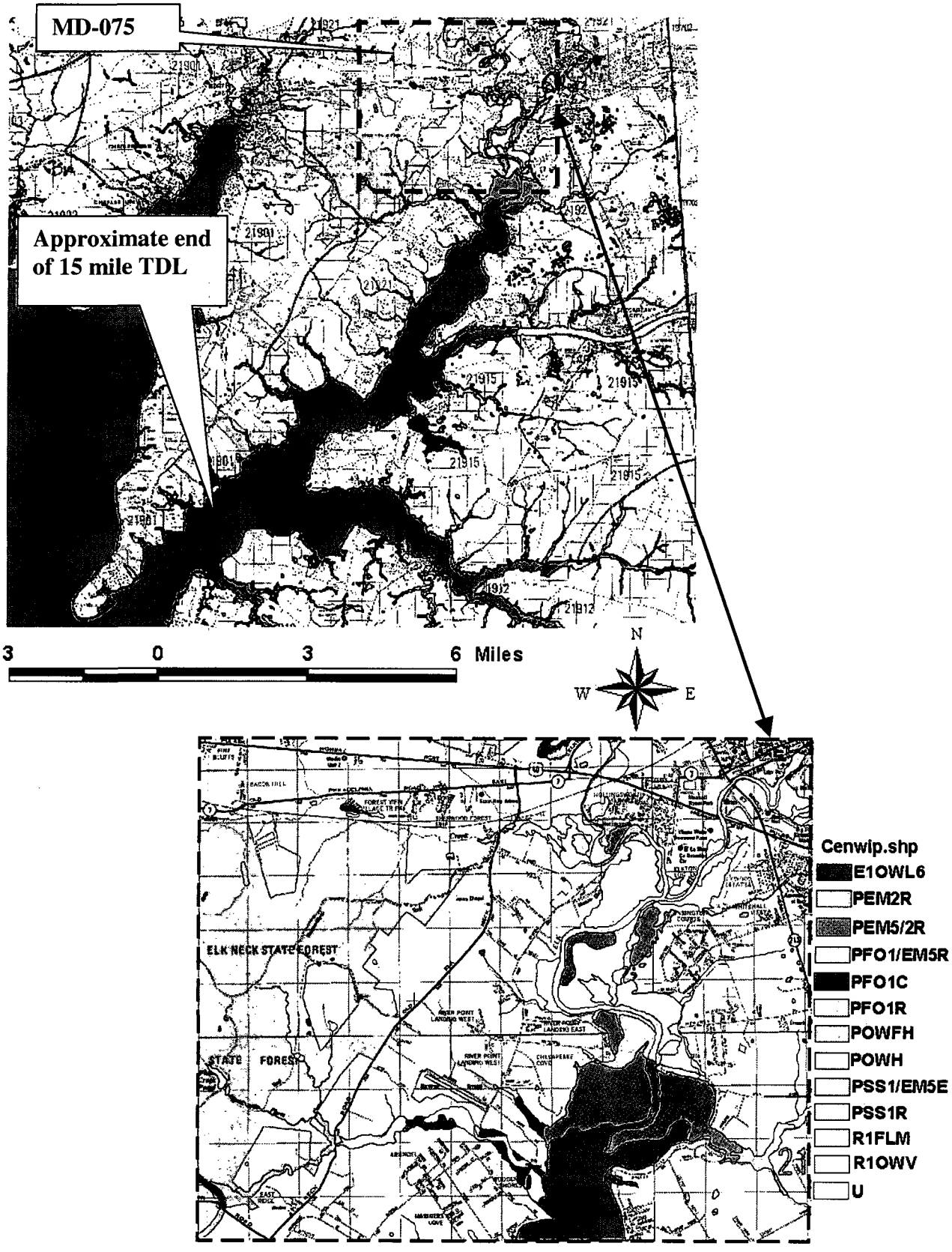

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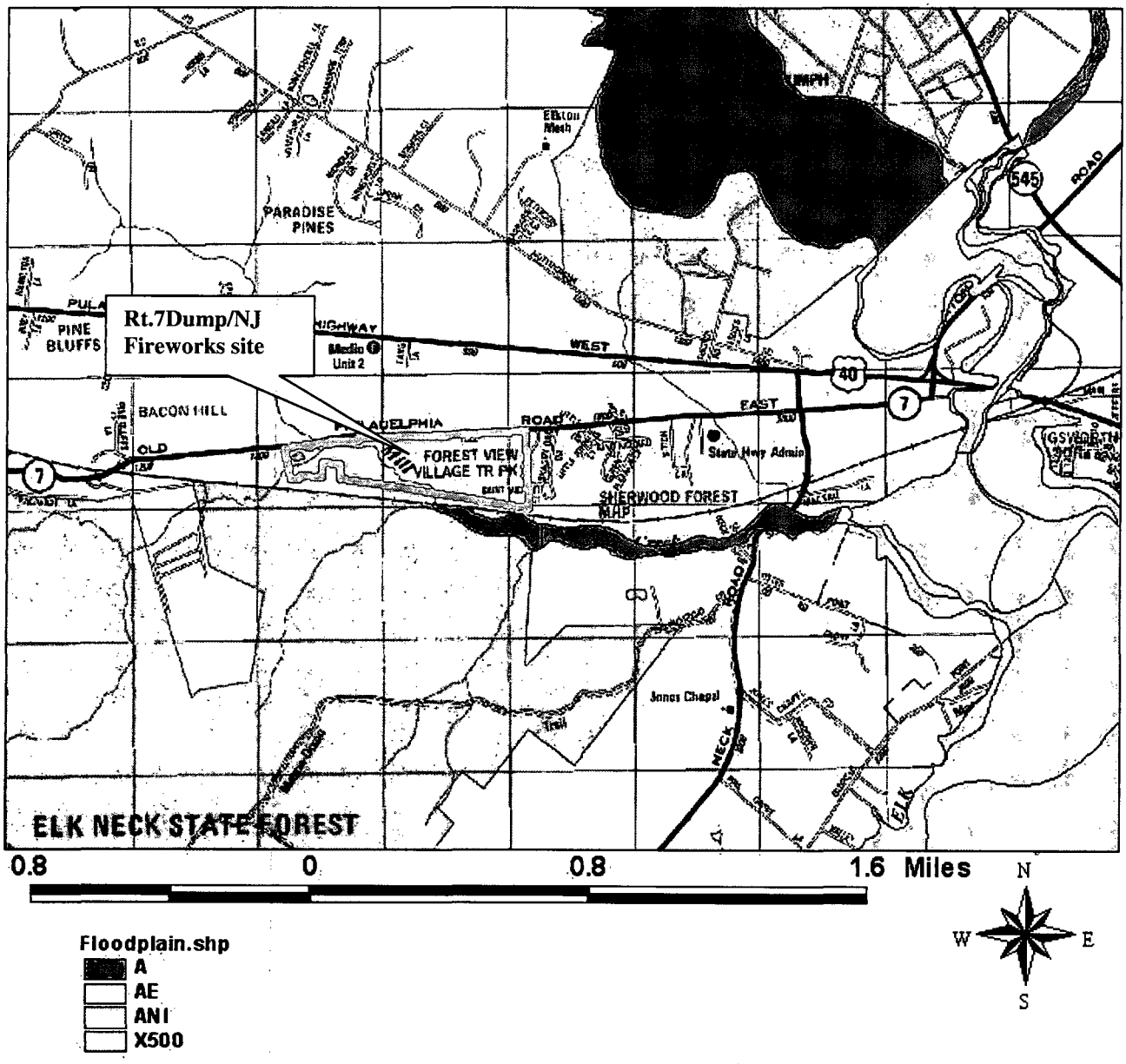
Figure 3: Floodplain Map



3.3 Soils

The soils occurring on and around the site are of the Keyport series developed in old Coastal Plain deposits, which range from gravelly, loamy sand to clay. Areas with a mantle of sandy loam, loam, or silty loam are moderately well drained. Otherwise water moves slowly through the subsoil in the Keyport.

3.4 Geology and Groundwater

The Rt.7 Chemical Dump/NJF Site is located in the Coastal Plain Physiographic Province that is characterized by a wedge-shaped series of southeastward dipping layers of unconsolidated sediments. Thickness of these sediments underlying the site and overlying Precambrian crystalline bedrock are estimated at approximately 150 to 200 feet, based on driller's logs.

Quaternary alluvial deposits made up of unconsolidated clays, silts, sands and gravels to depths of up to approximately 10 feet overlie the study area. These deposits are underlain by the Potomac Group, which is made up of an irregular succession of lenses and layers of gravelly sand, sand, silt, and clay, as well as various intermediate mixtures of these that accumulated in a fluvial environment and are therefore, lenticular and discontinuous even over short distances. (The Geology of Cecil County, Maryland, Bulletin 37, 1990). These sediments rest upon a complex of metamorphic and igneous rocks. The metamorphic rocks are mica and chlorite schists, gneisses, and metadacites. The igneous rocks are both intrusive and volcanic.

The Potomac Group provides the main source of water for this area and can be broken down further into the Patapsco and Patuxent formations. The Patuxent formation, which rests unconformably on the basement rock, is conformably overlain by the Patapsco formation. The Patuxent sediments are continental in origin and are very similar to the sediments of the Patapsco in that they both contain lenses of sand which hold much of the groundwater for this region.

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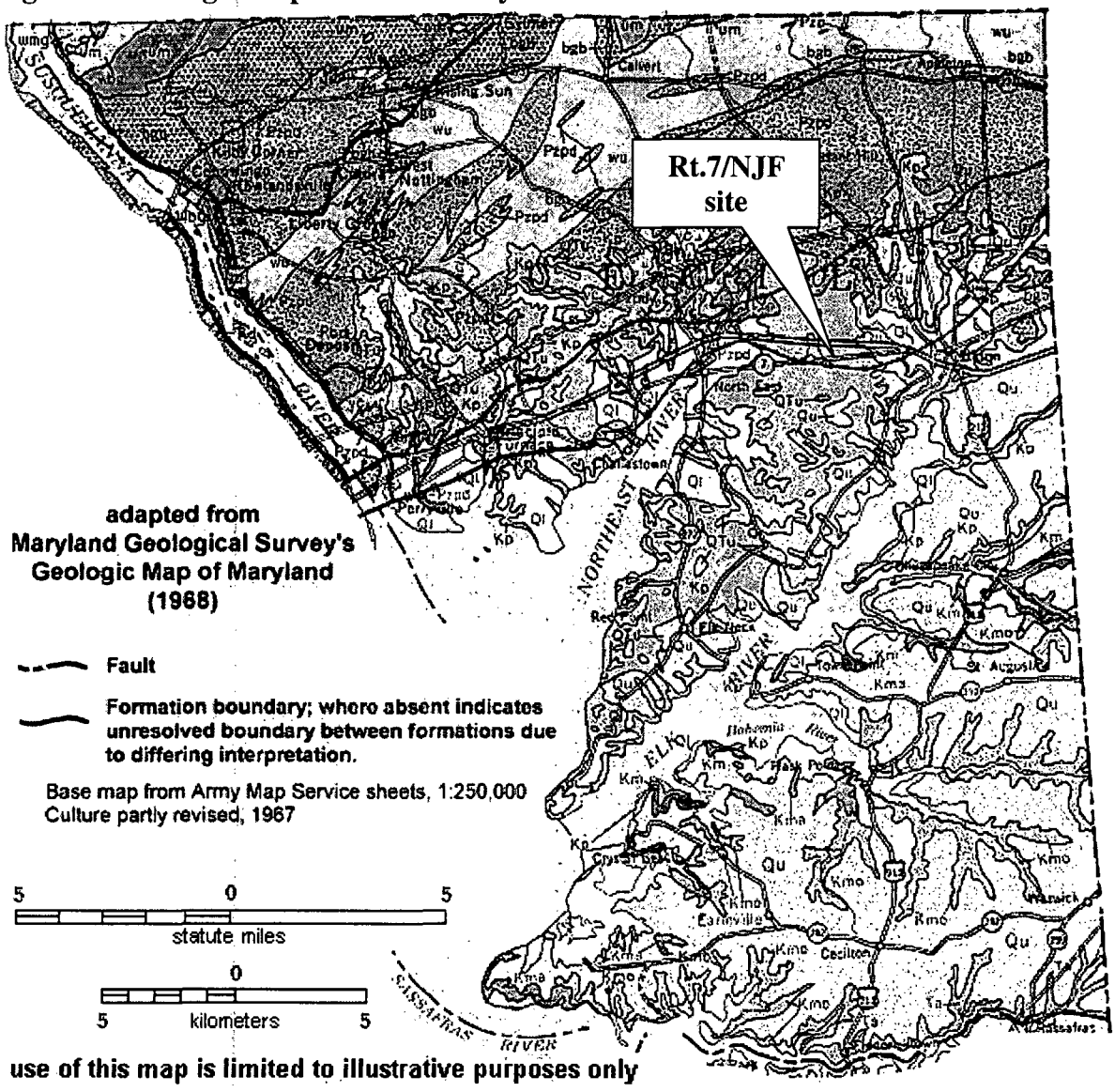
Figure 4: Geologic Map of Cecil County



3.5 Meteorology

Cecil County has a humid, continental climate with well-defined seasons. The warmest part of the year is July and the coldest is the last part of January. Annual temperatures range from 90° F to 20° F. Prevailing winds are from the west-northwest to northeast. From May through September, the winds become more southerly. The average annual wind speed is approximately 10 miles per hour. The average annual rainfall is 43 inches per year and the annual evaporation is 35 inches per year producing a net precipitation of 8 inches per year. The 2-year 24-hour rainfall is 3.0 inches in Cecil County.

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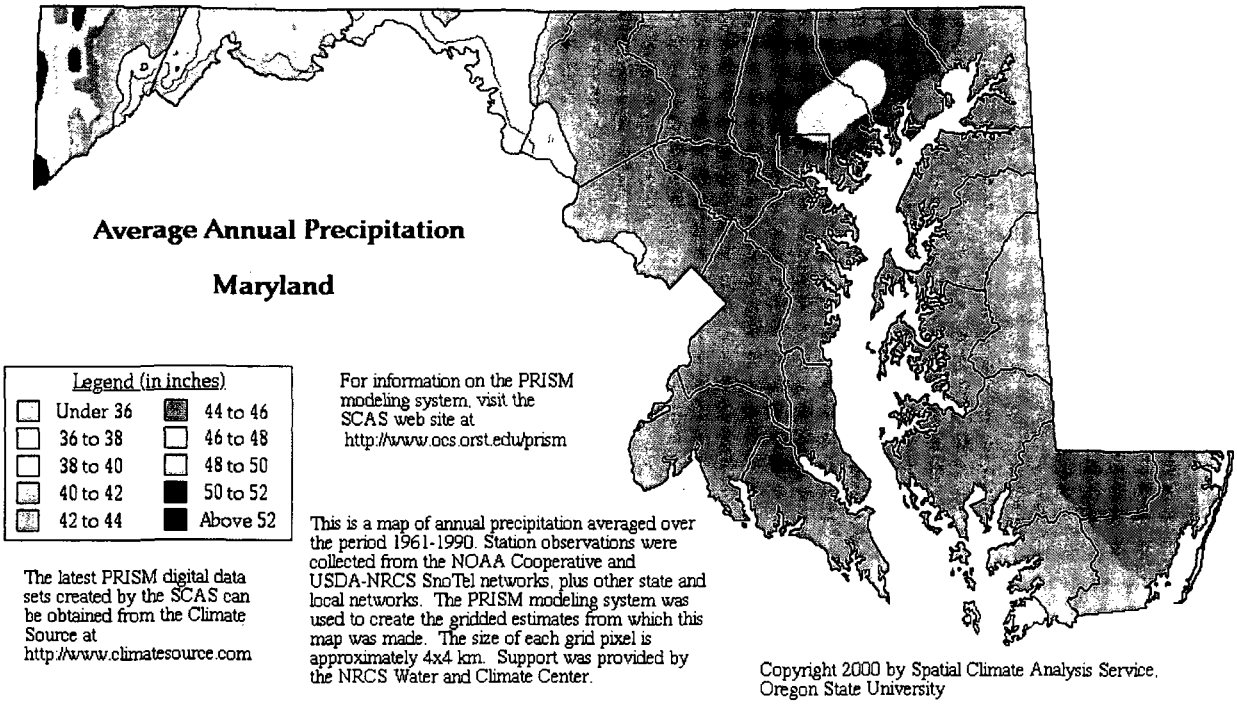
Figure 5: Precipitation Map



3.6 Nearby Land Use and Population Distribution

The Rt. 7 Dump/NJF site is located in a predominately residential and commercial area in rural Cecil County approximately 2.5 miles west of Elkton (Figure 6). The population within a 4-mile radius of the site is outlined in Table 2.

Table 2: Population Distribution Within 4-Miles of the Site

Distance from the site (miles)	Estimated Population from 2000 Census	Estimated Growth Since 2000	Total Estimated Population
0 – 1/4	81	7	88
1/4 – 1/2	172	14	186
1/2 – 1	586	48	634
1 – 2	2672	219	2891
2 – 3	7737	634	8371
3 – 4	10,048	824	10,872
Total			**23,042**

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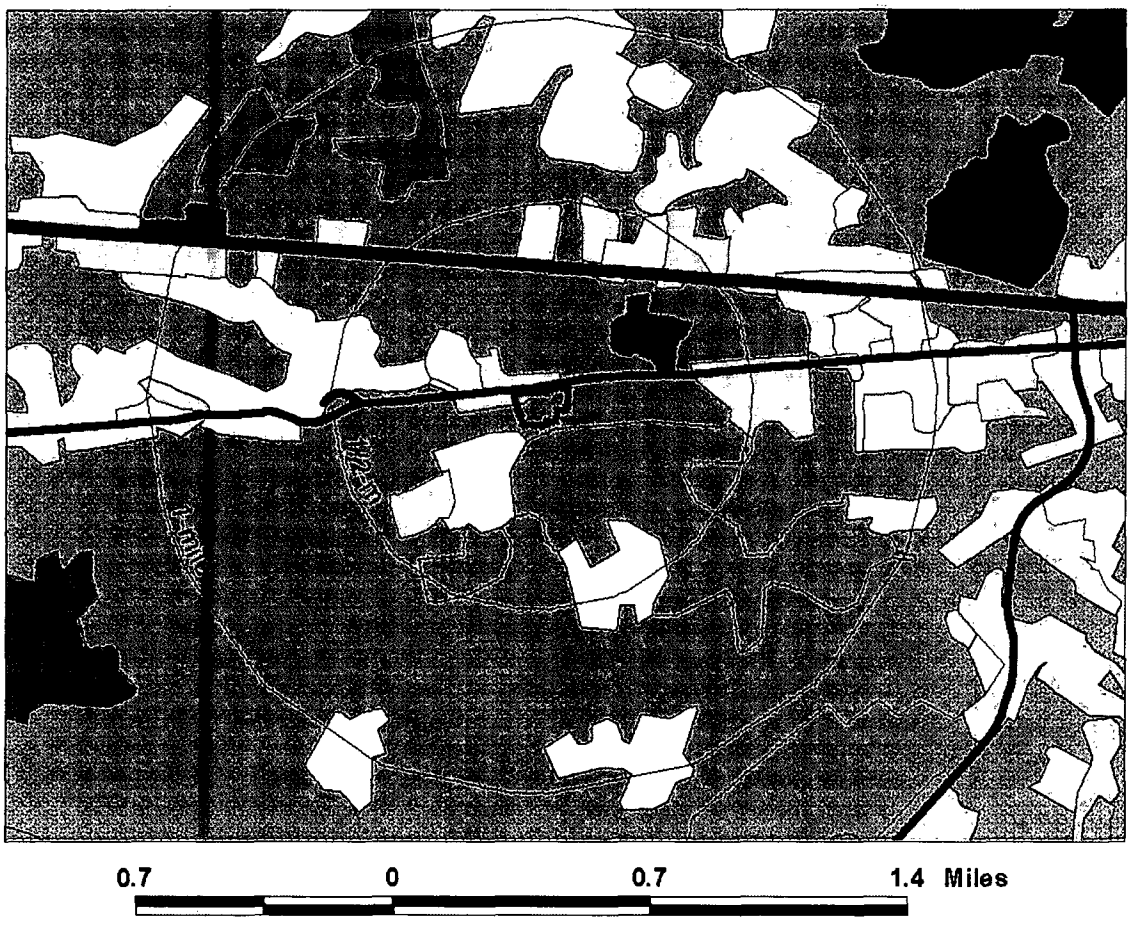
Figure 6: Land Use Within ¼ -Mile of the Site



4.0 WASTE DESCRIPTION

Wastes disposed and burned in the former Rt.7 Dump quarry include burned class C fireworks, by-products from munitions production, road construction debris, miscellaneous debris and deteriorated drums. Compounds included in the manufacture of class C fireworks and sparklers concentrated near the sparkler building area of NJF are potassium perchlorate, barium nitrate, copper oxide, alcohol and aluminum. Chlorinated solvents were also used as cleaning agents in the manufacturing process. Miscellaneous debris observed in a waste pile located in the drainage into Mill Creek included wooden pallets, possible asbestos-containing building materials, aerosol cans, oil cans, various auto parts and trash. Deteriorated drums were observed scattered about in the wooded sections of the property. Much of these wastes have been cleaned up and removed from the site.

5.0 PREVIOUS INVESTIGATIONS

The State of Maryland conducted a Preliminary Assessment and Ecology & Environment conducted a sampling of the Rt. 7 Chemical Dump in 1980, at which time results indicated contamination of the on-site ponded area. No other details were given other than the contamination had not migrated off-site.

In December 1983, the EPA (NUS Halliburton) conducted a Site Inspection of the Rt. 7 Chemical Dump that included collecting samples from on-site surface waters and an adjacent stream. Lead detected in upstream and downstream aqueous samples was determined to be unrelated to the site. Only butyl benzyl phthalate (15 parts per billion [ppb]) was detected in aqueous samples, and it was determined to pose no evident hazard. A high concentration of barium (19,300 ppb) was detected in the on-site pond aqueous sample, but no barium was detected off-site. Trace amounts of cadmium, cobalt, and chromium were also detected.

In June 1992, the MDE submitted a Level I Hazard Ranking System score on the dump site to EPA, and reported that NJF Company still owned the site, and confirmed that the State Highway Administration disposed of fill dirt from road construction in the on-site pond from 1983 to 1986. MDE recommended considering the site for No Further Remedial Action Planned (NFRAP) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

In September 1992, MDE submitted to EPA a revised Level I Site Inspection Prioritization (SIP) on the Rt. 7 Chemical Dump, which recommended a NFRAP status for the site, based on existing analytical data.

The MDE conducted a Site Inspection (SI) focused on the NJF portion of the property in April 2000. Surface and subsurface soil, groundwater, surface water and sediment samples were collected and analyzed for a full scan of all priority pollutants, which include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated

biphenyls (PCBs), total metals and cyanide. Analysis of select solid and aqueous samples failed to reveal the presence of perchlorates. The toxicological evaluation revealed unacceptable risk from ingestion of surface soil and groundwater, and dermal contact with groundwater beneath the site.

In October 2001, MDE met with NJF representatives and it was determined that MDE would collect soil samples to further characterize the burn pit area and areas near the buildings and trailers that still contained potentially hazardous wastes. Results from the field screening conducted on December 21, 2001 revealed elevated levels of antimony at the entrance of two of the buildings.

On March 1, 2002, MDE collected additional field screening samples approximately 10' to 20' from the building entrances to determine if metals contamination was restricted to those areas. An area devoid of vegetation near the former sparkler manufacturing building was sampled and elevated levels of barium (35,400 parts per million [ppm] and 39,300 ppm) were detected.

On May 2, 2003 the Waste Management Administration became involved in an investigation of perchlorate in the groundwater impacting the Elkton well field. In response to known perchlorate contamination of groundwater at the nearby ATK (formerly Morton Thiokol) MD-100 CERCLA site, MDE's Water Management Administration assessed nearby community wells. Chemical analysis of samples collected from two nearby community wells revealed perchlorate contamination at 5 ppb in one of the wells. Two additional community wells considered for planned development of the Forest View Mobile Home Park were sampled and perchlorates were detected at 28 ppb and 3 ppb.

Due to the detections of perchlorate in the community wells indicated above, MDE conducted two phases of residential and community well sampling for perchlorate contamination in September and November 2003. Included in this study was the NJF production well (approximately 50 feet deep) that revealed perchlorate contamination at 202 ppb in September 2003 and 790 ppb in November 2003.

6.0 FIELD OPERATIONS

6.1 Contract Laboratory Protocol (CLP) Sampling

EPA Region III approved the ESI Sampling and Analyses Plan on June 16, 2004. Sampling was conducted on August 3 – 5, 2004 in accordance with the plan and the procedures outlined in EPA's CLP Routine Analytic Services Case Number 33178, Special Analytical Service Case Number R31935 (for perchlorate analyses) and MDE's Standard Operating Procedures document.

The scope of this ESI evaluates the potential impacts from operations at the former disposal area (Rt. 7 Dump) and the sparkler building area on the NJF site on the soil, groundwater, surface water and sediments on and off site. Samples were collected and submitted for analysis in accordance with the CLP Routine Analytic Services. Because the previous

investigations, as summarized in Section 5.0, revealed only inorganic contamination above benchmark levels and some low level organic contamination, all samples (solid matrix and aqueous matrix) collected for this ESI were analyzed for Target Analyte List (TAL) inorganics, Target Compound List (TCL), SVOCs and pesticides. Since previous investigations failed to reveal detectable levels of VOCs in the aqueous samples and PCBs in any of the samples, aqueous samples collected during this ESI were not analyzed for VOCs and no samples were analyzed for PCBs. The soil samples were analyzed for VOCs. Due to the recent discovery of perchlorate contamination in the groundwater on site and in the vicinity, Special Analytical Services were requested for perchlorate analyses in all aqueous samples using EPA method 314 and all solid samples using EPA method 9058 (ion chromatography methods). A subset of the positive results was re-analyzed using liquid chromatography/mass spectrophotometry to verify the initial positive results for perchlorates. The samples were collected in five sample matrices: 1) organic aqueous, (2) organic solid, (3) inorganic aqueous and (4) inorganic solid and (5) dissolved metals in groundwater. CLP protocol was followed throughout the sample collection and submittal process (U.S. EPA, "Users Guide to CLP" December 1988) for those samples that apply. The quality control used by MDE includes the submittal of a field duplicate for each matrix, as defined above. In addition, a solid and aqueous matrix spike sample was collected at specified additional volumes for CLP matrix spike quality control procedures.

In response to the recent discovery of perchlorate contamination in nearby residential and community wells in the Mill Creek drainage basin and known perchlorate contamination in the Little Elk Creek Basin from the ATK perchlorate plume (approximately 1 mile northwest of this study area), six 2-inch monitoring wells were installed to assess the potential perchlorate contamination sources in the Mill Creek basin (a former pit on the Quality Enterprises property, the Rt.7 Dump and the NJF sparkler building) (Figure 7). A monitoring well (screened at 4 to 14 feet bgs) was installed adjacent to the southeast edge of the former Rt. 7 Dump to assess potential releases and impacts (mainly from perchlorates) to the water table and another monitoring well (screened 47 to57 feet bgs to the first local confining layer) was installed to assess a potential connection to the contaminated NJF production well that is situated approximately 0.5–mile to the east and is at a similar elevation (approximately 55 feet MSL) and screened at a similar interval (approximately 50 feet bgs). Additionally, a monitoring well (screened at 50 to 60 feet bgs) was installed on the Quality Enterprises property near the former pit to characterize that potential source which may have received fireworks production wastes and a deeper monitoring well (screened at 80 to 100 feet bgs) was installed assess potential contamination in water bearing zones above the existing contaminated well on site (screened at 125 to 130 feet bgs). A fifth monitoring well (screened at 59 to 69 feet bgs) was installed approximately 325 feet east of the NJF sparkler building in the vicinity of the nearby community wells to characterize the same impacted water-bearing zone as the NJF production well. An additional monitoring well for the same scope and depth was planned for installation approximately 1,000 feet further east; however, this well was screened at the only water-bearing zone encountered (16 to 36 feet bgs) during advancement to 70 feet bgs.

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Table 3: Sampling Rationale

SAMPLES TYPE	ID#		Rationale
Surface and Sub-Surface Soil	S-11/SS-11		Characterize potentially impacted soil near the Rt. 7 Dump.
	S-12/SS-12		Characterize potentially impacted soil near the Rt. 7 Dump.
	S-13/SS-13		Characterize potentially impacted soil near the Rt. 7 Dump.
	S-14/SS-14		Characterize potentially impacted near the Rt. 7 Dump.
	S-15		*Soil matrix duplicate of S-11.*
	S-16		Background soil sample to be collected east of the Rt. 7 Dump.
	S-21/SS-21		Characterize potentially impacted soil near the NJF sparkler building.
	S-22/SS-22		Characterize potentially impacted soil near the NJF sparkler building.
	S-23/SS-23		Characterize potentially impacted soil near the NJF sparkler building..
	S-24/SS-24		Characterize potentially impacted soil near the sparkler building and solid matrix spike.
	SS-25		*Soil matrix duplicate of SS-21.*
Surface Water and Sediment	SW-1	SED-1	Surface water sediment background collected from north branch of Mill Creek immediately north of Rt. 7.
	SW-2	SED-2	Surface water sediment background collected from south branch of Mill Creek upstream from the Rt. 7 Dump.
	SW-3	SED-3	Characterize the PPE into Mill Creek from the Rt. 7 Dump.
	SW-4	SED-4	Characterize the surface water and sediment at least 0.1 mile downstream from the PPE.
	SW-5	SED-5	Surface water sediment background upstream from the sparkler building area.
	SW-6	SED-6	Characterize the PPE into the unnamed tributary near the sparkler building.
	SW-7	SED-7	Characterize the surface water and sediment at least 0.1 mile downstream from the PPE.
	SW-8	SED-8	Characterize Mill Creek immediately upstream from the confluence of the unnamed tributary that flows near the sparkler building area.
	SW-9		Characterize the standing water on the Rt. 7 Dump.
	SW-10		*Aqueous matrix duplicate of SW-8.*
	SW-11		*Trip blank for day 1.*
	S.W-12		*Field blank for day 1.*
	SW-13		*Second day trip blank.*
	SW-14		*Second day field blank.*
Groundwater	MW-1	MW-1A	Characterize the groundwater near the Rt. 7 Dump.
	MW-2	MW-2A	Characterize the groundwater near the NJF sparkler building.
	MW-3	MW-3A	Characterize the groundwater immediately north of the study area.
	MW-4		Characterize the groundwater potentially migrating off site to the east.
	PW-5		Characterize the groundwater near the NJF production well and aqueous matrix spike.
	GW-1		Characterize the groundwater at the water table near the Rt. 7 Dump.
	GW-2		Characterize the groundwater at the water table near the sparkler building area.
	GW-3		*Aqueous matrix duplicate of MW-2.*

Figure 7: Monitoring Well, Surface Water and Sediment Sampling Locations

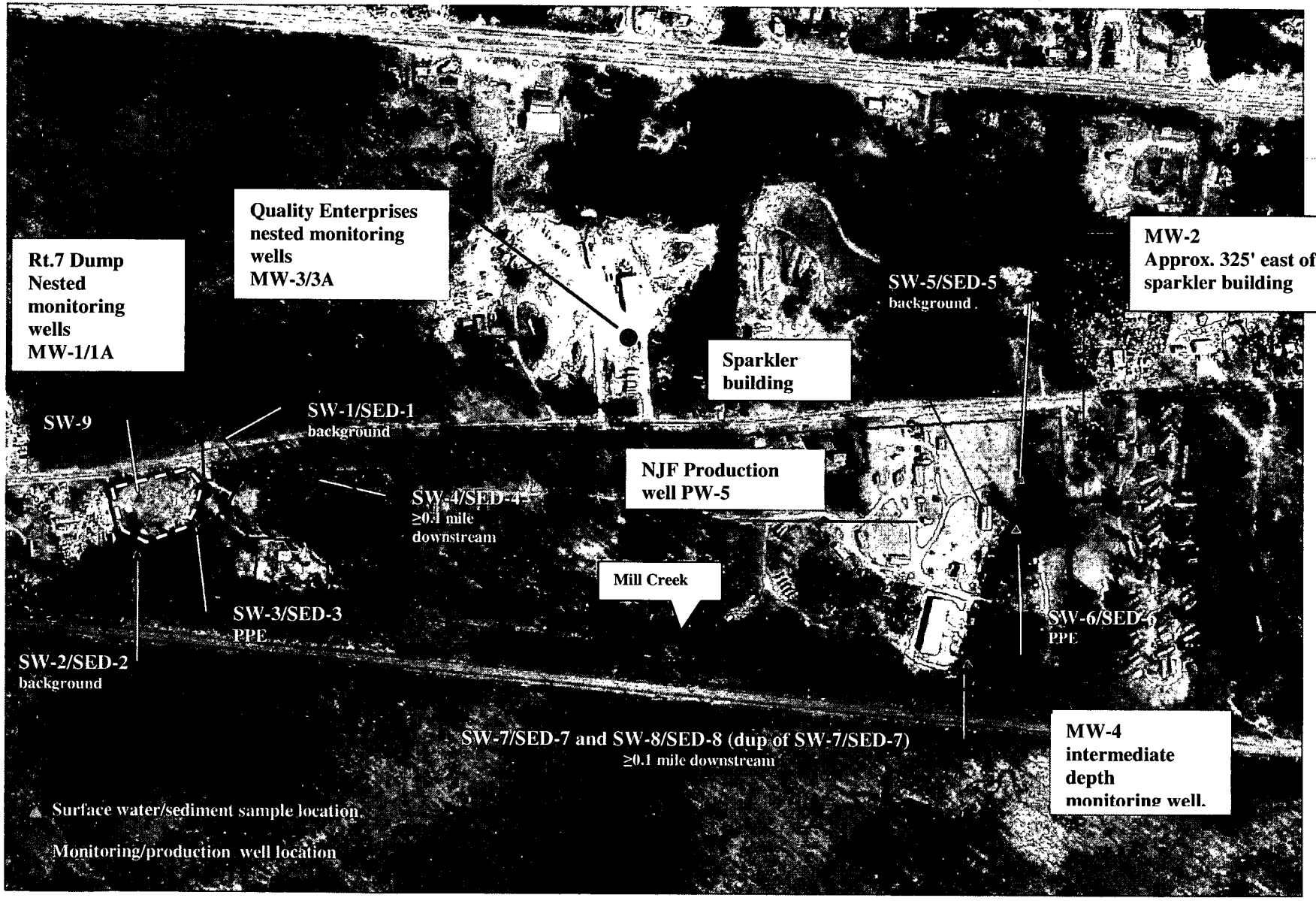
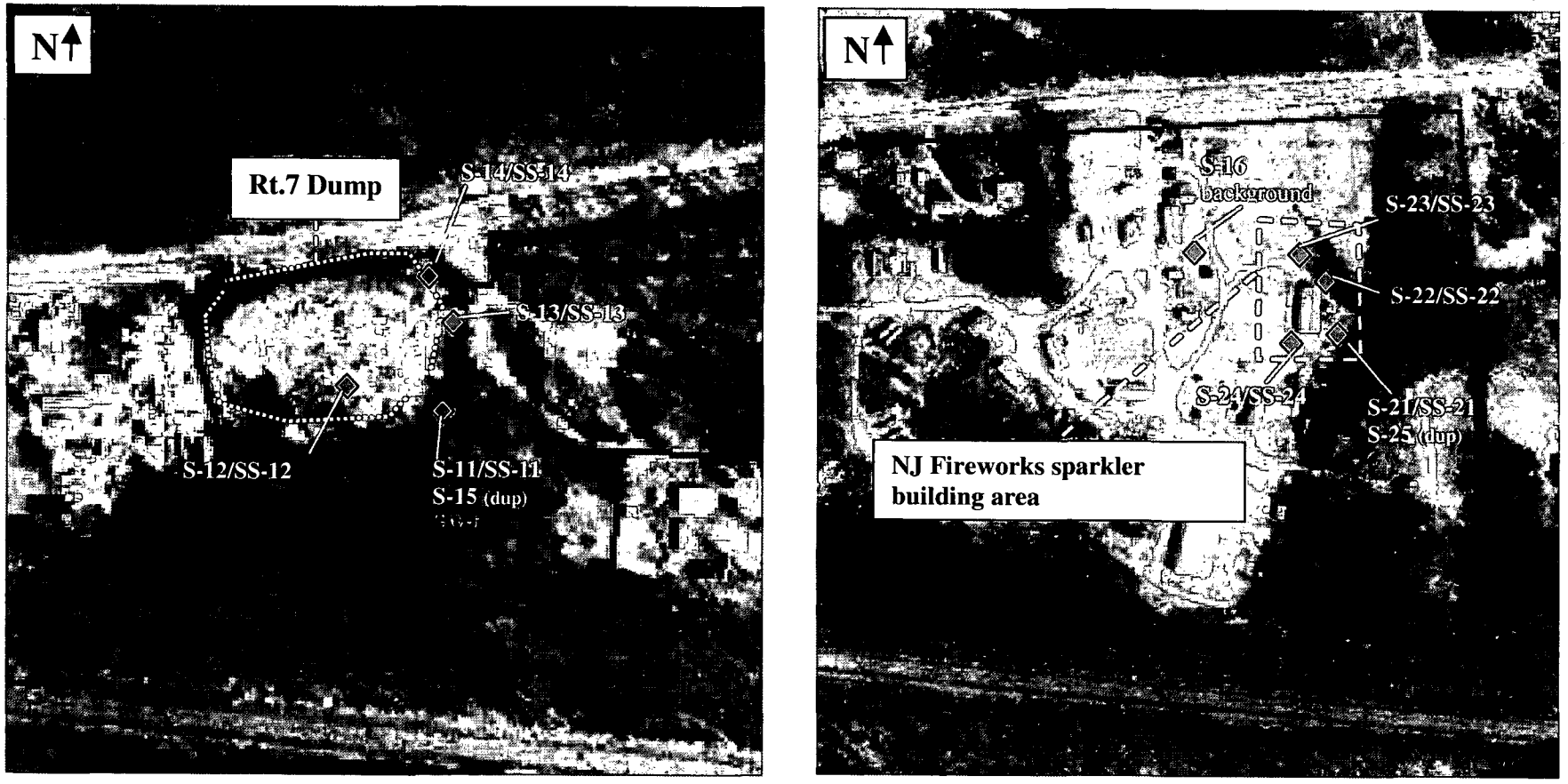


Figure 8: Soil and Groundwater Sampling Locations



7.0 CLP ANALYTICAL RESULTS

7.1 Groundwater Sampling Results

MDE collected seven groundwater samples from six monitoring wells on and in the vicinity of the Rt.7 Dump/NJF area (designated as MW-# plus a duplicate designated as GW-3), one groundwater sample from the NJF production well (designated as PW-5) and one groundwater sample from the water table near the NJF sparkler building area (GW-2). The groundwater sample (GW-1) from a temporary well was proposed to be collected near the former Rt. 7 Dump area was screened in a perched zone with limited recharge and only yielded enough volume for collection of a perchlorate sample (Figure 8). As shown in Table 4, inorganic contamination was detected throughout the groundwater sampling. Most notable is the elevated levels of metals detected in the unfiltered sample collected from the shallow monitoring well on the Rt. 7 Dump site (MW-1) and the elevated level of barium detected in the water table near the sparkler building (GW-2). As expected, filtering reduced the levels of the concentrations of the detected inorganics. Barium, however, was still present at an order of magnitude above MDE August 2001 Cleanup Standards in the two aforementioned groundwater samples. As shown in Table 5, only trace levels of three SVOC constituents were detected in the groundwater samples. As shown in Table 6, perchlorate was detected in the groundwater samples collected near the sparkler building, the shallower Quality Enterprises well screened at 50-60 feet bgs and in furthest of the two wells located east of the sparkler building and screened at 16-36 feet bgs. The perchlorate concentrations were screened against the newly established (February 18, 2005) EPA Drinking Water Equivalent Level (DWEL) of 24.5 ppb. The DWEL assumes that all of the contaminant absorbed by the body comes from the drinking water. The DWEL is a level (with a built in margin of safety) at which no adverse health effects are expected. Because of the margin of safety, exposures above the DWEL are not necessarily considered unsafe. Only GW-2, the water table sample near the sparkler building, exceeded the DWEL at 385 μg/L.

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Table 4: Inorganic Results for Groundwater Sampling

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW2 Water table near sparkler building (5'-10')	GW3 Dup of MW-3	MW1 Rt.7 Dump Screened (4'-14')	MW1A Rt. 7 Dump (47'-57')	MW2 @ 325' east of sparkler building	MW3 Quality Enterprises (80'-100')	MW3A Quality Enterprises (50'-60')	MW4 Sherwood Forest (16'-36')	PW5 NJF Production well (@50')
Unfiltered											
ALUMINUM	*50*	*37,000*	**23200**	**1010**	**88300**	**449**	**172 J**	**1030**	**9200**	**11000**	**14.2 J**
ARSENIC	*50*	*.045*	**20**	ND	**77.5**	ND	**3.3 J**	ND	ND	**41.1**	ND
BARIUM	*2,000*	*2,600*	**43700**	**230**	**31500**	**34.9 J**	**18.9 J**	**219**	**337**	**99.6 J**	**12.5 J**
BERYLLIUM	*4*	*73*	**1.6 J**	**0.31 J**	**15.5**	**0.31 J**	**1.3 J**	**0.28 J**	**3.3 J**	**0.96 J**	**0.25 J**
CADMIUM	*5*	*18*	ND	ND	**5.2**	ND	ND	ND	ND	ND	ND
CHROMIUM	*100 (Cr^{6+})*	*110 (Cr^{6+})*	**230**	**35.6**	**328**	**38.6**	ND	**32.1**	**124**	**335**	ND
COBALT	*73*	*730*	**28.9 J**	**7.5 J**	**331**	**6.3 J**	**16.1 J**	**7.4 J**	**85**	**9.8 J**	**16.6 J**
COPPER	*1,300*	*1,500*	**57.9**	**11.4 J**	**322**	**6.4 J**	ND	**10.7 J**	**234**	**82.9**	**16.8 J**
LEAD	*15*	--	**25.6**	ND	**151**	ND	ND	ND	**16.7**	**19.4**	ND
MANGANESE	*50*	*730*	**185 J**	**27 J**	**1940 J**	**18.7 J**	**26.5 J**	**25 J**	**59.1 J**	**1520 J**	**10.7 J**
NICKEL	*73*	*730*	**18 J**	**21.4 J**	**181**	**13 J**	**34.3 J**	**19.3 J**	**187**	**13.4 J**	**28.7 J**
SELENIUM	*50*	*180*	**17 J**	ND	**57.2**	ND	ND	ND	ND	**30.2 J**	ND
THALLIUM	*2*	*2.6*	ND	ND	**12.7 J**	ND	ND	ND	ND	**5.1 J**	ND
VANADIUM	*50*	*37*	**204**	**15.9 J**	**637**	**7.7 J**	**1 J**	**14.5 J**	**120**	**218**	ND
ZINC	*1,100*	*11,000*	**61.7**	ND	**620**	ND	ND	ND	**123**	ND	ND
Dissolved Fraction (field filtered)											
ALUMINUM	*50*	*37,000*	ND	ND	ND	ND	ND	ND	**190 J**	ND	ND
ARSENIC	*50*	*.045*	ND	ND	**8.2 J**	ND	ND	ND	ND	ND	ND
BARIUM	*2,000*	*2,600*	**37800**	**196 J**	**26000**	**31.8 J**	**50.6 J**	**206**	**130 J**	**70.2 J**	**12.2 J**
BERYLLIUM	*4*	*73*	ND	**0.054 J**	ND	**0.22 J**	**1.3 J**	**0.085 J**	**1.7 J**	ND	**0.24 J**
CADMIUM	*5*	*18*	ND	**0.56 J**	ND	**0.4 J**	**0.38 J**	**0.56 J**	**0.88 J**	**0.64 J**	**2.2 J**
CHROMIUM	*100 (Cr^{6+})*	*110 (Cr^{6+})*	ND	ND	ND	ND	ND	ND	ND	ND	ND
COBALT	*73*	*730*	**22.8 J**	**5.8 J**	**17.2 J**	**9.2 J**	**18.3 J**	**8.5 J**	**81.3**	**11.1 J**	**16.8 J**
COPPER	*1,300*	*1,500*	ND	ND	ND	**2.9 J**	ND	ND	**173**	ND	**17 J**
LEAD	*15*	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
MANGANESE	*50*	*730*	**100 J**	**14.2 J**	**383 J**	**22.5 J**	**30.1 J**	**19.4**	**47.5 J**	**1540**	**11 J**
MERCURY	*2*	--	ND	**0.094 J**	ND	ND	ND	ND	ND	ND	ND
NICKEL	*73*	*730*	**2.9 J**	**10.6 J**	**1.9 J**	**12.3 J**	**34.6 J**	**12.4**	**160**	**6.9 J**	**27.9 J**
THALLIUM	*2*	*2.6*	ND	ND	ND	**4.6 J**	ND	ND	ND	**5.5 J**	**4.8 J**
VANADIUM	*50*	*37*	ND	ND	ND	ND	ND	**0.95 J**	ND	ND	ND
ZINC	*1,100*	*11,000*	ND	ND	ND	ND	ND	ND	**100**	ND	ND

Qualifier: J – Analyte present, but reported value may not be accurate or precise. ND: Not detected. Analytes highlighted in yellow exceed MDE and/or EPA standards. * The Cleanup Standard for iron is based on secondary maximum contaminant levels. --: MDE or EPA has not established Cleanup Standards.

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Table 5: Organic Results for Groundwater Sampling

Detected Analytes (µg/L)	MDE Cleanup Standards	EPA RBC (tap water)	GW2 Sparkler building	GW3 Dup of MW3	MW1 Rt. 7 Dump (4-14 ft.)	MW1A Rt. 7 Dump (47'-57')	MW2 @325 ft. east of the sparkler building (59-69 ft.)	MW3 Quality Enterprises (80'-100')	MW3A Quality Enterprises (50-60 ft).	MW4 Sherwood Forest (16'-36')	PW5 NJF production @ 50 ft.
BIS (2-ETHYLHEXYL) PHTHALATE	*48*	*4.8*	ND	**1 J**	ND	**2 J**	ND	**4 J**	ND	ND	ND
PHENOL	*2,200*	*11,000*	ND	**4 J**	ND	ND	ND	**6 J**	ND	ND	ND
CHRYSENE	*10*	*3.2*	ND	**1 J**	ND	ND	ND	ND	ND	ND	ND

Qualifiers: J- Analyte present, the reported value may not be accurate or precise. ND- not detected. Analytes highlighted in yellow exceed MDE and/or EPA standards. – MDE or EPA has not established cleanup standards.

Table 6: Perchlorates Results in Groundwater Sampling

Perchlorate detections (µg/L)	EPA DWEL (ppb)	GW1 Rt. 7 Dump	GW2 Sparkler building	GW3 Dup of MW3	MW1 Rt. 7 Dump (4-14 ft.)	MW1A Rt. 7 Dump (47-57 ft.)	MW2 @325 ft. east of the sparkler building (59-69 ft.)	MW3 Quality Enterprises (80-100 ft.)	MW3A Quality Enterprises (50-60 ft).	MW4 Sherwood Forest (16-36 ft.)	PW5 NJF production @ 50 ft.
	24.5	ND	385	4.79	ND	ND	ND	ND	5.07	22.6	21.0

Analytes highlighted in yellow exceed the EPA DWEL.

7.2 Surface Water Sampling Results

MDE collected nine surface water samples from Mill Creek including a north and south branch at the former Rt. 7 Dump area and an unnamed tributary near the NJF sparkler building area. As shown in Table 7, low levels of inorganics were detected in the surface water samples. Barium was detected in both the unfiltered and filtered fractions of the surface water samples at levels greater than three times the background sample. Only thallium was detected at levels above Maryland's Toxic Substance Criteria for Ambient Surface Water (Code of Maryland Regulations, Volume XXXIV, Subtitle 26.08.02,03-2). Only one organic compound was detected in the surface water samples (di-n-butylphthalate) and it was detected below the contract required detection limit of 10 µg/L. As shown in Table 8, perchlorate was detected in the surface water samples collected only from the unnamed tributary of Mill Creek nearest the sparkler building (SW-6, SW-7 and SW-8) and at levels greater than three times the background. Perchlorate was detected at the probable point of entry (PPE) and approximately 0.1-mile downstream just upstream from the confluence with Mill Creek. Currently, there are no MDE or EPA benchmark standards for perchlorate contamination of surface waters.

Table 7: Inorganic Results For surface Water Sampling

Analyte (µg/L)	COMAR			SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9
	Aquatic Life Acute	Aquatic Life Chronic	Fish Consumption	Rt. 7 Dump background northern branch	Rt. 7 Dump background southern branch	Rt. 7 Dump PPE	>0.1 mile downstream from Rt.7 Dump	Sparkler building background	Sparkler building PPE	>0.1 mile downstream from sparkler building	Dup. of SW7	Standing water on Rt. 7 Dump
Unfiltered												
ALUMINUM				372 K	558	359	359	ND	351	150 J	893	ND
ANTIMONY	340	150	4,300	ND	ND	ND	ND	8.1 J	ND	ND	ND	ND
BARIUM	--	--	--	33.8 J	43 J	48.1 J	50.8 J	170 J	2590 J	2030 J	2270 J	1840 J
BERYLLIUM	--	--	--	0.087 J	0.18 J	0.13 J	0.11 J	ND	ND	ND	ND	ND
CHROMIUM	--	--	--	2.8 J	1.8 J	1.4 J	2 J	2.5 J	2.1 J	1.1 J	3.5 J	0.61 J
COBALT	--	--	--	2.3 J	3.6 J	3.6 J	3.3 J	22.5 J	5.7 J	2.2 J	4.2 J	1.2 J
COPPER	13	9	1,300	2.2 J	ND	ND	ND	2.2 J	4.5 J	4.7 J	6.1 J	0.98 J
CYANIDE	22	5.2	222,000	ND	2.2 J	ND	ND	3.2 J	2.8 J	2.3 J	3.6 J	ND
LEAD	65	2.5	--	ND	ND	ND	ND	ND	ND	ND	6.3 J	ND
MANGANESE	--	--	--	54	69.5	78	68.5	6150	1540	697	1080	332
NICKEL	470	52	4,600	7.6 J	7.7 J	7.8 J	7.5 J	6.6 J	5.6 J	4.6 J	5.8 J	2 J
THALLIUM	--	--	6.3	ND	ND	ND	ND	8.5 J	4.1 J	ND	ND	ND
VANADIUM	--	--	--	2.1 J	1.7 J	0.84 J	1 J	ND	1.9 J	0.9 J	3.6 J	ND
ZINC	120	120	69,000	ND	ND	ND	ND	ND	ND	ND	25.5 J	ND
Dissolved Fraction (field filtered)												
ANTIMONY	340	150	4,300	ND	ND	ND	ND	8.5 J	ND	ND	ND	ND
BARIUM				28.9 J	39 J	45.7 J	51.4 J	161 J	2430 J	2030 J	2040 J	1830 J
BERYLLIUM	--	--	--	0.037 J	0.085 J	0.067 J	0.06 J	ND	ND	ND	ND	ND
CHROMIUM	--	--	--	1.5 J	0.68 J	0.53 J	1.5 J	2.5 J	1.1 J	0.92 J	1.1 J	0.42 J
COBALT	--	--	--	6.6 J	7.1 J	7.4 J	7.3 J	25.6 J	7.1 J	2.6 J	6.6 J	4.9 J
COPPER	13	9	1,300	2 J	2.4 J	3.4 J	2.5 J	1.5 J	3.2 J	3.5 J	3.5 J	ND
MANGANESE				54.8	68	79.5	74	6020	802	661	769	309
NICKEL	470	52	4,600	7.5 J	6.7 J	7.3 J	8.4 J	6.9 J	5.9 J	4.3 J	4.7 J	2.3 J
SILVER	3.4	--	--	ND	ND	ND	ND	1.1 J	ND	ND	ND	ND
THALLIUM	--	--	6.3	ND	ND	ND	ND	9 J	3.1 J	ND	ND	ND
VANADIUM	--	--	--	ND	ND	ND	ND	ND	0.68 J	ND	ND	ND
ZINC	120	120	69,000	ND	ND	ND	ND	18.6 J	ND	ND	ND	ND

Qualifiers: J – Analyte present, but reported value may not be accurate or precise. K – Analyte present, reported value may be biased high, actual value is expected to be lower. Values in red are significantly above (>3 times) background. Analytes highlighted in yellow exceed COMAR standards.-- - No standard.

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Table 8: Perchlorate Results in Surface Water Sampling

	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9
Perchlorate detections (µg/L)	Rt. 7 Dump background	Rt. 7 Dump background	Rt. 7 Dump PPE	>0.1 mile downstream from Rt.7 Dump	Sparkler building background	Sparkler building PPE	>0.1 mile downstream from sparkler building	Dup. of SW7	Standing water on Rt. 7 Dump
	ND	ND	ND	ND	ND	**8.51**	**7.65**	**7.52**	ND

Values in red are significantly above (>3 times) background.

7.3 Sediment Sampling Results

As shown in Table 9, barium, lead, manganese, nickel, and zinc were detected in the sediment samples at levels significantly above the background sample at the former Rt. 7 Dump. Barium was the only metal detected in the sediment associated with the sparkler building source at levels greater than three times the background. Arsenic, chromium, lead, mercury, and zinc were detected in the sparkler building background sample at levels that exceed National Oceanic and Atmospheric Administration (NOAA) Threshold Effects Limits (TEL) for freshwater sediments and/or Effects Range Median (ERM) values. As shown in Table 10, of the fifteen organic compounds detected in the sediment sampling, only five organic compounds were detected at levels exceeding NOAA TEL standards. However, those exceedances were reported at estimated levels less than the contract required detection limits (CQRL). As shown in Table 11, perchlorate was detected in the sediment sample closest to the sparkler building, the PPE to the nearest surface water body at a level greater than three times the background. Currently, there are no MDE and EPA benchmark standards for perchlorate contamination in sediments.

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Table 9: Inorganic Results For Sediment Sampling

Analyte (mg/Kg)	NOAA Standard ERM	NOAA Standard TEL	SED-1 Rt. 7 Dump background	SED-2 Rt. 7 Dump background	SED-3 Rt. 7 Dump PPE	SED-4 >0.1 mile downstream from Rt.7 Dump	SED-5 Sparkler building background	SED-6 Sparkler building PPE	SED-7 >0.1 mile downstream from sparkler building	SED-8 Dup. of SW7
ALUMINUM	--	--	730	697	2020	278	6420	2990	3150	6060
ANTIMONY	--	--	ND	ND	ND	ND	103 L	5.2 J	8.7 L	11 L
ARSENIC	*70*	*5.9*	0.67 J	ND	1.2 J	ND	6.3 L	4.6 L	3.4 L	4.8 L
BARIUM	--	--	4.6 J	15.1 J	27.8 J	2.2 J	213 J	562 J	925 J	1610 J
BERYLLIUM	--	--	0.066 J	0.11 J	0.38 J	0.046 J	0.45 J	0.45 J	0.28 J	0.44 J
CADMIUM	*9.6*	*0.596*	ND	ND	ND	ND	1	0.21 J	ND	0.35 J
CHROMIUM	*370*	*37.3*	7.8	5.3	9.4	3.2	17.7	17.7	15	25.5
COBALT	--	--	0.5 J	0.74 J	4.2 J	0.73 J	17	3.5 J	2.9 J	7.8 J
COPPER	*270*	*35.7*	1.8 J	3 J	6.5	1.2 J	32.3	4.3	13.5	19.2
LEAD	*218*	*35*	2.6	3.5	10.6	1.1 J	64.7	7	23.3	41
MANGANESE	--	--	7.7	5.6	31.3	10.1	2150	315	213	850
MERCURY	*0.71*	*0.174*	ND	ND	0.084 J	0.079 J	0.22	ND	ND	0.068 J
NICKEL	*51.6*	*18*	1.3 J	1.9 J	5.9	0.81 J	12.6	2.1 J	3.6 J	7.9
SILVER	*3.7*	--	ND	ND	ND	ND	0.32 J	ND	ND	ND
THALLIUM	--	--	ND	ND	ND	ND	4.2	0.78 J	ND	1.7 J
VANADIUM	--	--	5 J	5.3 J	9.9	2.3 J	21.1	27.3	17.7	26.9
ZINC	*410*	*123.1*	4.9 J	5.5 J	23.7	4.5 J	153	15.9	31	53.9

Qualifiers: J – Analyte present, but reported value may not be accurate or precise. L – Analyte present, but reported value may be biased low; actual value is expected to be higher. Values in red are significantly above (>3 times) background. Values highlighted in yellow exceed NOAA ERM and/or TEL values. – No Standard.

Table 10: Organic Results For Sediment Sampling

Analyte (μg/Kg)	NOAA Standard ERM	NOAA Standard TEL	SED-1 Rt. 7 Dump background	SED-2 Rt. 7 Dump background	SED-3 Rt. 7 Dump PPE	SED-4 >0.1 mile downstream from Rt.7 Dump	SED-5 Sparkler building background	SED-6 Sparkler building PPE	SED-7 >0.1 mile downstream from sparkler building	SED-8 Dup. of SED-7
VOCs										
1,1,1-TRICHLOROETHANE	--	--	ND	ND	ND	ND	ND	18	ND	ND
1,1-DICHLOROETHENE	--	--	ND	ND	ND	ND	ND	3 J	ND	ND
TETRACHLOROETHENE	--	--	ND	ND	ND	ND	ND	15	ND	ND
TRICHLOROETHENE	--	--	ND	ND	ND	ND	ND	1 J	ND	ND
SVOCs										
4-METHYLPHENOL	--	--	ND	ND	ND	ND	ND	ND	860	280 J
BENZALDEHYDE	--	--	ND	ND	ND	ND	ND	ND	74 J	54 J
BENZO[A]ANTHRACENE	1600	15.72	ND	ND	75 J	ND	140 J	ND	ND	ND
BENZO[A]PYRENE	1600	31.7	ND	ND	69 J	ND	ND	ND	ND	ND
BENZO[B]FLUORANTHENE	--	--	ND	ND	100 J	ND	230 J	ND	ND	ND
BENZO[K]FLUORANTHENE	--	--	ND	ND	79 J	ND	170 J	ND	ND	ND
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	500	570	150 J	130 J	550	380 J	600	670
CHRYSENE	2800	57.1	ND	ND	110 J	ND	190 J	ND	ND	ND
FLUORANTHENE	5100	111	ND	ND	130 J	ND	230 J	ND	ND	ND
INDENO[1,2,3-CD]PYRENE	--	--	ND	ND	56 J	ND	ND	ND	ND	ND
PYRENE	2600	53	ND	ND	130 J	ND	260 J	ND	ND	ND

Qualifiers: J – Analyte present, but reported value may not be accurate or precise. Values highlighted in yellow exceed NOAA ERM and/or TEL values. -- - No standard.

Table 11: Perchlorate Results in Sediment Sampling

	SED-1	SED-2	SED-3	SED-4	SED-5	SED-6	SED-7	SED-8
Perchlorate detections (μg/Kg)	Rt. 7 Dump background	Rt. 7 Dump background	Rt. 7 Dump PPE	>0.1 mile downstream from Rt.7 Dump	Sparkler building background	Sparkler building PPE	>0.1 mile downstream from sparkler building	Dup. of SW7
	ND	ND	ND	ND	ND	**103**	ND	ND

Values in red are significantly above (>3 times) background.

7.4 Soil Sampling Results

As shown in Tables 12 and 13, metals contamination was detected throughout the surface and subsurface soil sampling and most were detected at levels greater than three times their respective background samples. Arsenic, barium, and mercury were detected in the surface soil samples at levels exceeding MDE and/or EPA benchmark standards. Only arsenic exceeded benchmark levels in the subsurface soil samples. Higher levels of inorganic contamination, especially barium, were detected in the samples collected near the sparkler building area confirming impacts to the soil attributable to former fireworks manufacturing operations. As shown in Tables 14 and 15, a total of fourteen organic compounds were detected in the soil samples. Only bis(2-ethylhexyl)phthalate and 4,4'-DDE were detected at levels above their CQRL and at levels three times greater than background. As shown is Tables 16 and 17, perchlorates were detected in the soil samples collected from both of the potential source areas (former Rt. 7 Dump and the sparkler building area). The perchlorate concentrations detected in the surface and subsurface soil samples were greater than three times the background sample confirming attribution of perchlorate contamination to former fireworks manufacturing near the sparkler building and fireworks waste disposal at the former Rt. 7 Dump. However, there are no MDE and EPA benchmark standards for perchlorate contamination in residential or non-residential soils at this time.

Table 12: Inorganic Results For Surface (0-2') Soil Sampling

Detected Analytes (mg/kg)	MDE Standard Non-(Residential) (mg/kg)	EPA RBC (Industrial) (mg/kg)	S11	S12	S13	S14	S15 Dup of S11	S16 Background	S21	S22	S23	S24	S25 Dup of S21
Aluminum	200,000	1,000,000	4280	5620	7490	7570	4400	3300	40200	12300	9420	3980	64000
Antimony	82	410	1.5 J	ND	1.7 J	1.5 J	1.1 J	1 J	9.7 L	4.3 J	4.9 J	ND	12.5 L
Arsenic	3.8	1.9	3.2	6.1	2.9	6	3.5	2.1	14.2	5.3	4	2.6	18.9
Barium	14,000	72,000	57.1	23 J	599	102	29.2	51.2	30500 +	5500 +	27.3	501	47600 +
Beryllium	410	2,000	0.3 J	0.23 J	0.33 J	0.51 J	0.44 J	0.13 J	0.23 J	0.34 J	0.2 J	0.16 J	0.15 J
Cadmium	100	1,000	0.21 J	0.25 J	0.44 J	0.61 J	0.27 J	ND	2.8	0.68	0.4 J	ND	1.8
Chromium	610 (as Cr^{6+})	3100 (as Cr^{6+})	14.9	21.8	20.7	28.3	18.2	12	150	42.9	20.6	12.8	187
Cobalt	4,100	20,000	3 J	3.6 J	3.4 J	4.1 J	4.8 J	2.1 J	19.9	7.3	1.6 J	1.2 J	30.6
Copper	8,200	41,000	22	13	20	18.8	13.9	6.2	162	31.3	7	5.5	200
Lead	400	--	26.7 J	2.1 J	112 J	130 J	12.1 J	16.6 J	40.3 J	20.8 J	7.6 J	13.1 J	42 J
Manganese	4,100	140,000	34.4	72.1	113	77.2	38.8	63.6	693	455	47	8.7	824
Mercury	0.12	--	ND	ND	ND	ND	ND	ND	1.7	ND	ND	ND	1.4
Nickel	4,100	20,000	6.2	62	11.7	23.6	7.4	2.5 J	147	21.5	3.8 J	2.4 J	147
Selenium	1,000	5,100	ND	ND	ND	ND	ND	ND	6.7	ND	ND	ND	ND
Silver	1000	5,100-	ND	0.43 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	14	72	0.66 J	ND	ND	ND	ND	ND	1.3 J	0.57 J	ND	ND	0.66 J
Vanadium	1,400	1,000	20.5	9.8	23.5	31.7	24.7	12	28.4	24.8	27.5	14.5	27.3
Zinc	61,000	310,000	20.8 J	12.4 J	40 J	91.7 J	24.3 J	11.5 J	81.4 J	28.6 J	10.8 J	8.8 J	94.7 J
Cyanide	4,100	20,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.7	ND

Qualifiers: J – Analyte present, but reported value may not be accurate or precise. L – Analyte present, but reported value may be biased low; actual value is expected to be higher. Values in red are significantly above (>3 times) background. + - Result reported from dilution analysis. Values highlighted in yellow exceed an August 2001 MDE Non-Residential Soil Cleanup Standard and/or EPA RBC for non-residential soil. – No Standard.

Table 13: Inorganic Results For Subsurface (4-6') Soil Sampling

Detected Analytes (mg/Kg)	MDE Standard Non-Residential	EPA RBCs Industrial	SS11	SS13	SS14	SS21	SS22	SS23	SS24
Aluminum	200,000	1,000,000	6450	1350	8610	12400	8620	4250	5630
Arsenic	3.8	1.9	1.8	6.4	3.9	6.2	4	11.3	3
Barium	14,000	72,000	47	37.5	33.8	5990 +	866	10.1 J	85.4
Beryllium	410	2,000	0.51 J	0.46 J	0.31 J	0.27 J	0.49 J	0.38 J	0.23 J
Cadmium	100	1,000	ND	ND	ND	0.26 J	ND	0.27 J	ND
Chromium	610 (as Cr^{6+})	3100 (as Cr^{6+})	15.2	27.2	16.3	61.3	28	77.6	25.9
Cobalt	4,100	20,000	4.8 J	3.9 J	3 J	4.6 J	2.1 J	3 J	1.5 J
Copper	8,200	41,000	5.9	8.4	6.2	31.4	5.8	13.6	6.9
Lead	400	--	6.3 J	4.2 J	13.7 J	12.4 J	5.6 J	7.3 J	5.7 J
Manganese	4,100	140,000	71.4	23.9	52.1	108	92.6	32.4	19.2
Nickel	4,100	20,000	6.8	4.3 J	7.2	27	4.6 J	2.3 J	3.1 J
Vanadium	1,400	7,200	19.7	37.4	23.1	35.2	34.2	64.9	19.5
Zinc	61,000	23,000	21.5 J	23.7 J	22.1 J	23.7	15 J	9.6 J	9.6 J

Qualifiers: J – Analyte present, but reported value may not be accurate or precise. L – Analyte present, but reported value may be biased low; actual value is expected to be higher. Values in red are significantly above (>3 times) background. + - Result reported from dilution analysis. Values highlighted in yellow exceed an August 2001 MDE Non-Residential Soil Cleanup Standard and/or EPA RBC for non-residential soil. – No Standard. .

Table 14: Organic Results For Surface (0-2') Soil Sampling

Analyte (µg/Kg)	MDE Cleanup Standard Non-Residential	EPA RBC Industrial	S11	S12	S13	S14	S15 Dup of S11	S16 background	S21	S22	S23	S24	S25 Dup of S21
VOCs													
TRICHLOROFLUOROMETHANE	--	310,000	ND	ND	ND	ND	ND	**3 J**	ND	ND	ND	ND	ND
SVOCs													
BENZO[A]ANTHRACENE	7,800	3900	ND	ND	**360 J**	**99 J**	ND	ND	ND	**85 J**	ND	ND	ND
BENZO[A]PYRENE	780	390	ND	ND	**350 J**	ND	ND	ND	ND	**110 J**	ND	ND	ND
BENZO[B]FLUORANTHENE	7,800	3900	ND	ND	**250 J**	ND	ND	ND	ND	**94 J**	ND	ND	ND
BENZO[G,H,I]PERYLENE	6.1 E+6		ND	ND	**160 J**	ND	ND	ND	ND	**84 J**	ND	ND	ND
BENZO[K]FLUORANTHENE	78,000	39000	**43 J**	ND	**280 J**	ND	ND	ND	ND	**84 J**	ND	ND	ND
BIS(2-ETHYLHEXYL)PHTHALATE	4.1 E+5	200,000	**140 J**	ND	ND	ND	**80 J**	ND	**760**	**210 J**	ND	**100 J**	**550**
CHRYSENE	78,000	390,000	**62 J**	ND	**460 J**	**150 J**	ND	ND	ND	**140 J**	ND	ND	ND
FLUORANTHENE	8.2 E+6	4.1 E+7	**72 J**	ND	**280 J**	**180 J**	ND	ND	ND	**140 J**	ND	ND	ND
INDENO[1,2,3-CD]PYRENE	7,800	3,900	ND	ND	**130 J**	ND	ND	ND	ND	**80 J**	ND	ND	ND
PHENANTHRENE	6.1 E+7	--	**43 J**	ND	ND	**79 J**	ND	ND	ND	**88 J**	ND	ND	ND
PYRENE	6.1 E+6	3.1 E+7	**77 J**	ND	**750 J**	**270 J**	ND	ND	ND	**210 J**	ND	ND	ND
PESTICIDES/PCBs													
4,4'-DDE	17,000	8,400	ND	ND	ND	**19**	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	17,000	8,400	ND	ND	ND	**5J**	ND	ND	ND	ND	ND	ND	ND

Qualifiers: J – Analyte present, but reported value may not be accurate or precise. -- - No standard. Analytes in red are significantly above (>3 times) background concentrations

Table 15: Organic Results For Subsurface (4-6') Soil Sampling

Analyte (µg/Kg)	MDE Standard Non-Residential	EPA RBC Industrial	SS11	SS13	SS14	SS21	SS22	SS23	SS24
VOCs									
1,1,1-TRICHLOROETHANE	5.7 E+7	3.1 E+8	ND	ND	ND	**2 J**	**1 J**	ND	ND
1,1-DICHLOROETHANE	2.0 E+7	1.0 E+8	ND	ND	ND	**2 J**	ND	ND	ND
1,1-DICHLOROETHENE	9,500	5.1 E+7	ND	ND	ND	ND	**1 J**	ND	ND
TETRACHLOROETHENE	1.1 E+5	140,000	ND	ND	ND	**4 J**	**3 J**	ND	**3 J**
SVOCs									
BIS(2-ETHYLHEXYL)PHTHALATE	4.1 E+5	200,000	**92 J**	ND	ND	**140 J**	ND	**89 J**	ND

Qualifiers: J – Analyte present, but reported value may not be accurate or precise. -- - No standard.

Table 16: Perchlorate Results in Surface Soil Sampling

Perchlorate detections (µg/Kg)	S-11	S-12	S-13	S-14	S-15 Dup of S11	S-16 background	S-21	S-22	S-23	S-24	S-25 Dup of S21
	ND	**6**	**25**	**18**	**9**	ND	**62**	**7**	ND	ND	**45**

Analytes in red are significantly above (>3 times) background concentrations.

Table 17: Perchlorate Results in Subsurface Soil Sampling

Perchlorate detections (µg/Kg)	SS-11	SS-13	SS-14	SS-21	SS-22	SS-23	SS-24
	ND	ND	ND	**36**	**2090**	ND	ND

Analytes in red are significantly above (>3 times) background concentrations.

8.0 TOXICOLOGICAL EVALUATION SUMMARY OF RISKS

MDE performed a toxicological evaluation of the CLP data obtained from the August 2004 Rt. 7 Dump /NJF ESI sampling event (Volume II, Appendix E). The major highlights regarding the preparation of the evaluation are as follows:

- A commercial use scenario was assumed for the purpose of estimating risk to potentially exposed populations.

- The potentially exposed populations considered were the construction worker, adult worker, youth visitor, child visitor, adult swimmer, youth swimmer, and child swimmer.

- Exposures to soil, sediment, groundwater, surface water, and vapors were considered.

- The potential exposure routes considered for soil were ingestion, inhalation, dermal contact, and vapor intrusion of volatiles into indoor air.

- The potential exposure routes considered for sediment were ingestion, inhalation, and dermal contact.

- The potential exposure routes considered for groundwater were ingestion, inhalation, dermal contact, and vapor intrusion of volatiles into indoor air.

- The potential exposure routes considered for surface water was incidental ingestion while swimming or wading.

- Risks from vapor intrusion of volatile and semi-volatile contaminants from soil and groundwater into indoor air were evaluated using the Johnson and Ettinger Tier I vapor intrusion model.

- Hazard indices and cancer risk values were calculated two ways; risk evaluations for residential populations using maximum detected concentrations, and risk evaluations using 95% upper confidence limit (UCL) concentrations for soil, and sediment only as the site-wide average concentration.

The estimated risks from the incidental ingestion of detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended risk levels for the child visitor and construction worker commercial populations utilizing both the maximum detected concentration and the 95% UCL concentration as the site-wide average concentration. Risk estimates for the incidental ingestion of detected carcinogenic surface soil contaminants exceeded MDE recommended risk levels for the child visitor commercial population utilizing the maximum detected concentration as the site-wide average concentration.

Risk estimates for dermal exposure to detected noncarcinogenic surface soil contaminants exceeded MDE and EPA recommended levels for the child visitor commercial population utilizing both the maximum detected concentration and the 95% UCL concentration as the site-wide average concentration. Risk estimates for dermal exposure to detected noncarcinogenic subsurface soil contaminants exceeded MDE and EPA recommended risk levels for the child visitor commercial population utilizing the maximum detected concentration as the site-wide average concentration. Dermal risk estimates should be viewed with caution, as there is a relatively high degree of uncertainty associated with some of the chemical constants used. The concentrations of lead detected in soils on site were less than the recommended 400 mg/kg screening level. Perchlorate was detected at the site but limited toxicological data was available for this compound. The lack of toxicological data adds a degree of uncertainty to the analysis. Based upon historical site operations and the detection of this chemical, it may represent a potential risk in specific locations across the site. Perchlorate, a primary component in solid propellant for rockets, was detected in the soils on site.

Potential adverse effects from groundwater exposure were evaluated using total and dissolved metals concentration data on site. Risk estimates from the incidental ingestion of detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for all commercial populations using total and dissolved metals data. Risk estimates

from the incidental ingestion of detected carcinogenic groundwater contaminants exceeded MDE recommended risk ranges for all commercial populations and EPA risk ranges for the child visitor, youth visitor and adult worker commercial populations using total metal data. Carcinogenic risk estimates for the incidental ingestion of detected groundwater contaminants exceeded MDE recommended risk ranges for the child visitor, youth visitor and adult worker commercial populations using dissolved metal data. Risk estimates for dermal contact with detected noncarcinogenic groundwater contaminants exceeded MDE and EPA recommended risk levels for the child visitor, adult worker and construction worker commercial populations using total metals data. The lack of critical physical constants and the methods for derivation of dermal exposures lead to a high degree of uncertainty associated with this route of exposure. This high degree of uncertainty should be considered when evaluating the hazards of dermal exposure to groundwater. Perchlorate was detected at the site but limited toxicological data was available for this compound. The lack of toxicological data adds a degree of uncertainty to the analysis. Based upon historical site operations and the detection of this chemical, it may represent a potential risk in specific locations across the site. Perchlorate, a primary component in solid propellant for rockets, was detected in groundwater on site.

Groundwater contaminant concentrations (dissolved metals data) were also compared to available Maryland ambient water quality standards (AWQS) or EPA recommended ambient water quality criteria (AWQC). Two detected groundwater contaminants (cadmium and copper) exceeded the AWQS or AWQC for the protection of aquatic life (acute or chronic) and two detected contaminants (arsenic and beryllium) exceeded their EPA recommended AWQC for the protection of human health through fish consumption.

Noncarcinogenic and carcinogenic risk estimates for the incidental ingestion of detected and nondetected surface water contaminants while swimming were below MDE and EPA recommended risk levels for all commercial populations. Surface water contaminant concentrations (dissolved metals data) were also compared to available Maryland AWQS or EPA recommended AWQC for freshwater environments. One detected surface water contaminant, silver, exceeded the freshwater AWQS or AWQC for the protection of aquatic life (acute or chronic) and two detected contaminants, arsenic and thallium, exceeded EPA fish consumption AWQC. The magnitude of these exceedances and the potential impact to receptors cannot be determined from the data available at this time.

9.0 FINDINGS AND CONCLUSION

Results of this investigation identified perchlorate contamination in the soil near the former Rt. 7 Dump area and especially near the sparkler building area at levels up to 2,090 µg/Kg. Perchlorate contamination was also detected in the surface water and sediments of the unnamed tributary of Mill Creek nearest the sparkler building. Elevated perchlorate contamination (at 385 µg/L in sample GW-2), exceeding the 24.5 ppb DWEL, was identified in the groundwater near the sparkler building. Perchlorate contamination was also identified in the NJF production well, both monitoring wells installed northwest of the sparkler building and one of the two monitoring wells installed east of the sparkler building area. Additionally, the soil sampling results identified elevated levels of metals (arsenic, barium, lead, and mercury) above

MDE and/or EPA standards, especially near the sparkler building (barium at 47,600 ppm). Based on the contamination noted above, past fireworks manufacturing and disposal activities have impacted the area near the former Rt. 7 Dump and the sparkler building area on the NJF property, as well as the nearby surface water and sediment. Perchlorate contamination may also have migrated with the likely easterly flow of groundwater that may be paralleling Mill Creek as evidenced by the contamination of wells to the east. Further investigation is recommended to characterize the perchlorate contamination detected in the monitoring wells installed northwest of the sparkler building source area.

The Toxicological Evaluation of the chemical analyses from the samples collected during the ESI utilized a commercial use scenario and revealed exceedances for noncarcinogenic and carcinogenic risks to child and youth visitor populations, and to the adult and construction worker populations. Exposure pathways posing unacceptable risk to the contamination that was detected on site are from one or more of the following: ingestion of, and dermal contact with the soil and groundwater. Based upon the unacceptable level of risk from exposure to the contamination that was detected on site, MDE is recommending further investigation to better characterize the sparkler building area for remedial actions and its impacts to the on and off site groundwater to include the perchlorate contamination detected monitoring wells installed northwest (upgradient of the anticipated groundwater flow direction) of the sparkler building.

10.0 REFERENCES

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3. MDE ERRP personnel site visits.
4. http://www.topozone.com.
5. MDE Water Management Administration Well Database.
6. U.S. Geological Survey, *Hydrogeological Framework of the Coastal Plain of Maryland, Delaware, and the District of Columbia*, Vroblesky and Fleck. January 1, 1991.
7. http://ocs.orst.edu/pub/maps/Precipitation/Total/States/MD/md.gif
8. U.S. Department of the Interior Geological Survey, *Characteristics of Streamflow in Maryland, Report of Investigations No. 35*, 1983.
9. http://www.mdmerlin.net/atlaslaunch.html
10. Code of Maryland Regulations, Volume XXIV, Subtitle 26.08.02.03-2, Table 1, Toxic Substances Criteria for Ambient Surface Waters.
11. U.S. Environmental Protection Agency, April 2003, Risk-Based Concentration Tables, Region III.
12. http://www.dnr.state.md.us/bay/tribstrat/upper_east/up_east_shore.html

ORIGINAL

11.0 PHOTODOCUMENTATION

Photo of S-21/SS-21, SS-25 and GW-2 facing northwest towards the sparkler building.

Photo of S-22/SS-22 facing west northwest towards the sparkler building.

Photo of S-23/SS-23 facing southeast towards the sparkler building.

Photo of S-24/SS-24 location facing northeast between the sparkler building and abandoned shed.

ORIGINAL

Photo of S-11/SS-11, S-15 (duplicate of S-11) and GW-1 facing northwest toward Rt. 7 Dump.

Photo of S-12 on the south central edge of the Rt. 7 Dump.

ORIGINAL

Photo of S-13/SS-13 and monitoring wells MW-1/1A facing north near the Rt.7 Dump.

Photo of S-14/SS-14 approximately 40' south of Rt.7 collected next to the treeline.

ORIGINAL

Photo of S-16, background sample collected 11' east of the production well house (PW-5).

Photo of MW-2 located against the tree line approximately 325' east of the sparkler building.

Photo of MW-3/3A facing east southeast on the Quality Enterprises property.

Photo of MW-4 located in the Sherwood Forest Mobile Home Park, facing south.

Photo of SW-1/SED-1 immediately upstream from the bridge across Rt.7, facing west.

Photo of SW-2/SED-2 located near the southwestern most edge of the Rt.7 Dump.

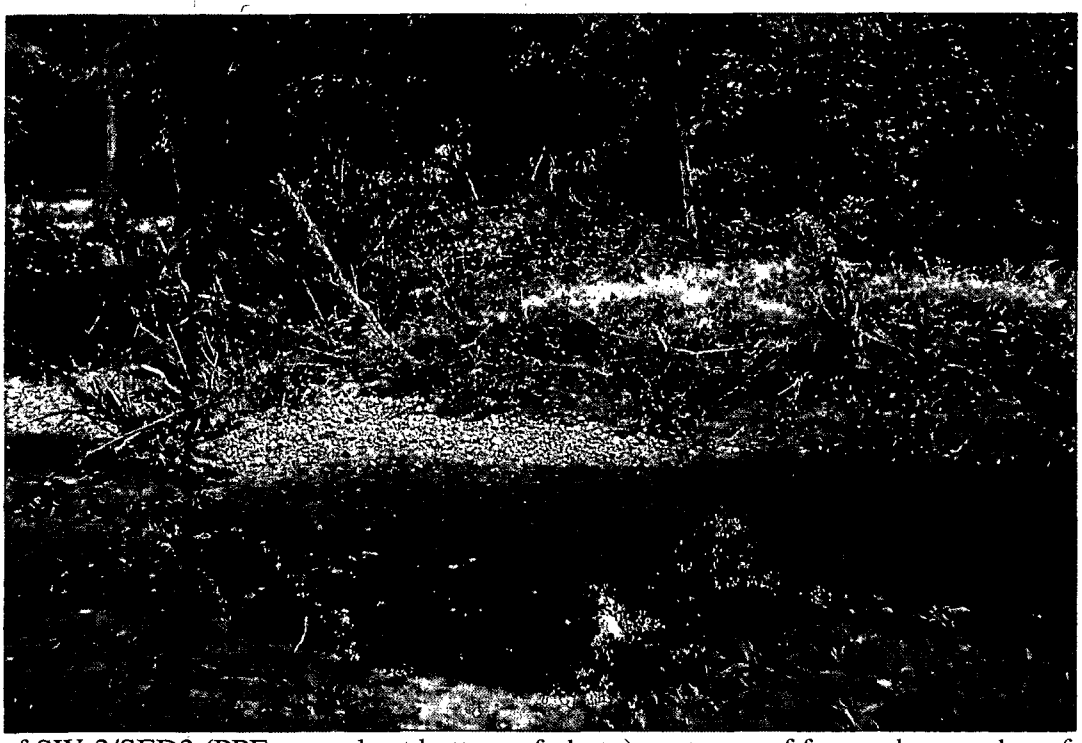

Photo of SW-3/SED3 (PPE at swale at bottom of photo) upstream of former beaver dam, facing south.

Photo of SW-4/SED-4 collected approximately 625' downstream from the Rt.7 Dump PPE.

ORIGINAL

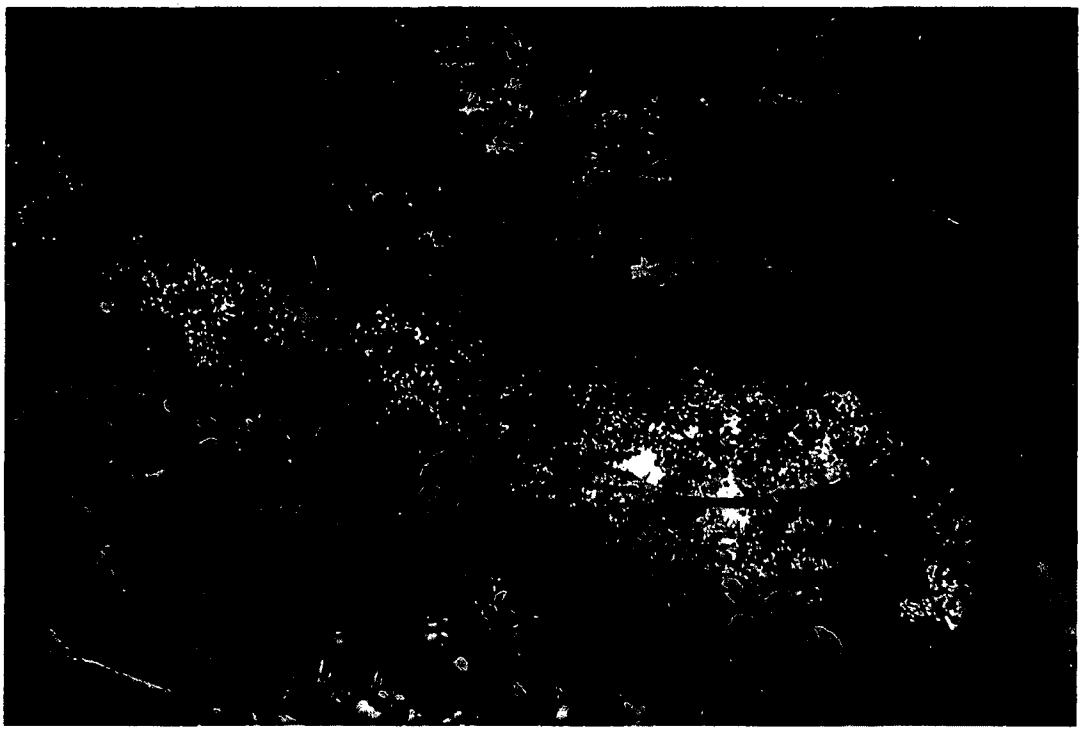

Photo of SW-5/SED-5, background of unnamed tributary near the sparkler building.

Photo of SW-7/SED-7 located approximately 600' downstream from the sparkler building PPE.